UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.

EXAMINER	
ART UNIT	PAPER NUMBER

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)

1- File Copy

*U.S. GPO: 2000-473-000/44602

Office Action Summary	Application No. 09/588,549	Applicant(s) OKUMURA ET AL.	
	Examiner Glen Kao	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-35 is/are pending in the application.

4a) Of the above claim(s) 6-12,31 and 32 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-5,13-30 and 33-35 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 07 June 2000 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

Application/Control Number: 09/588,549

Art Unit: 2882

DETAILED ACTION

Election/Restrictions

1. This application contains claims directed to the following patentably distinct species of the claimed invention:

I. Claims 1-5, 13-30, and 33-35, drawn to the specifics of the device of an optical encoder with grooves and driving in view of Igaki system comprising the first, second, sixth, tenth, twelfth, and thirteenth embodiment, which corresponds to Figures 9-13B; 14-16, 23A-25B, 32, 34, and 35.

II. Claims 6-9 and 31, drawn to the specifics of the device of an optical encoder with a specific number of slits and driving system comprising a third embodiment, which corresponds to Figures 17-19B;

III. Claims 10-12 and 32, drawn to the specifics of the device of an optical encoder with a particular surface and driving system comprising a fourth embodiment, which corresponds to Figures 20A and 20B;

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species. The species are patentably distinct because one species does not require the characteristics of another species. Group I involves an optical encoder with grooves. Group II involves the number of slits in an optical encoder. Group III involves the surface of an optical encoder. Because these inventions

are distinct for the reasons given above and the search required for Group I is not required for Group II or Group III, restriction for examination purposes as indicated is proper.

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

During a telephone conversation with Leonard P. Diana on October 5, 2001, a provisional election was made with traverse to prosecute the invention of Group I, claims 1-5, 13-30, and 33-35. Affirmation of this election must be made by applicant in replying to this Office action. Claims 6-12, 31, and 32 are withdrawn from further consideration by the examiner.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Information Disclosure Statement

2. The information disclosure statement filed on October 2, 2000 as Paper Number 5, is missing from the patent application and has not been considered. Another information disclosure statement filed on February 5, 2001 as Paper Number 6, (mailed by the Applicant on August 7, 2000), is in the patent application and has been considered as shown in the enclosure of this office action.

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description:

a) Fig. 5C, reference number "13b"

b) Fig. 14, reference number "26"

"26" may have been intended as "25" as denoted on page 18, line 27.

c) Fig. 16, reference numbers "13", "14", "15", and "16"

Those reference numbers may refer to "I3", "I4", "I5", and "I6" on page 19, lines 26 and 27.

d) Fig. 16, reference "Δ"

"Δ" may refer to "A" as denoted on page 17, line 8

e) Fig. 19A, reference "S1"

f) Fig. 19B, reference "S2"

g) Fig. 21A, reference "13" "13a" may have been intended instead.

h) Fig. 21B, reference "13" "13b" may have been intended instead.

i) Fig. 22B, reference "15a", "15b", and "15c"

j) Fig. 36, reference "D"

Correction is required.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because of the following informalities.

a) reference character "25a" has been used to designate two different light-receiving elements in Fig. 12B. One of them may have been intended as 25a', as denoted on page 16, line 27.

b) reference character "15a" has been used to designate two different light-receiving elements in Fig. 24B. One of them may have been intended as 15a', as denoted on page 26, line 22.

c) reference character "115a" has been used to designate two different light-receiving elements at different positions in Fig. 28. One of them may have been intended as 115a', as denoted on page 31, line 21.

Correction is required.

3. The Examiner notes the following inconsistency in Fig. 4B. "4a" does not represent the pitch of "4b". "4b" may have intended to be in place of "4a".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 16 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention for the phrase "slits in said second region comprises slopes of N types of angles in a number of P/N in one period where P is a pitch of the periodic structure of the scale slits and N a natural number" in claim 16, lines 17-21, and claim 34, lines 23-27. The only description of "the number of P/N in one period" is in the specification on page 3, lines 1-5. It is indefinite as to what the Applicant means for "the number of P/N" in one period.

5. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention for wavefront division by a difference between reflecting directions by said second region. The only description of that type of division is in the first region such as Figures 31-35.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 4, 5, 13-22, 26-30, 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Igaki et al. (JP 11-23324) in view of Igaki (US Patent 5,124,548).

7. Regarding claims 1, 4, 5, and 30, Igaki et al. (JP) discloses an optical encoder for detecting an angle, speed, or position of relative rotation or translation comprising (Abstract): a light irradiating system, an optical scale having grating for transmitting or reflecting incident light, light receiving elements disposed in a plurality of different directions (Drawing 14); and an optical system constructed to amplitude-modulate light by the transmitting or reflecting grating, by a dividing element in which a plurality of V-grooves are juxtaposed (Drawing 13) to divide the light along a plurality of different directions to the light-receiving elements, wherein the dividing element is comprised of repetitions of such a structure that V-grooves consisting of planes of mutually different angles are juxtaposed at a predetermined pitch (Detailed description, [0012], "trapezoid-like"), and wherein the dividing element and optical scale are comprised of a common member in an outside region or inside region of the grating (Drawing 13 and 14).

However, Igaki et al. (JP) does not specifically disclose a driving system comprising: a driver system, a control system, and the optical encoder.

Igaki teaches a driving system comprising: a driver system, a control system and the optical encoder (Fig. 14). Igaki also teaches different V-groove angles (col. 4, lines 46-52).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to incorporate the driving system of Igaki with the optical encoder of Igaki et al. (JP), since one would be motivated to have some form of an automated driving system to rotate the optical scale and operate as a feedback system as shown by Igaki (col. 6, lines 33-53).

8. Regarding, claims 13-15 and 33, Igaki et al. (JP) discloses an optical encoder for detecting an angle, speed, or position of relative rotation or translation comprising (Abstract): a light irradiating system, an optical scale having grating for transmitting or reflecting incident light, light receiving elements disposed in a plurality of different directions (Drawing 13), wherein light travels to the scale slits of a first region to a condensing mirror or optical element to a second region of scale slits (Drawing 13). However, Igaki et al. (JP) does not specifically disclose the slope angles different or smaller for the first region than those of the second region and a driving system comprising: a driver system, a control system, and the optical encoder.

Igaki teaches a driving system comprising: a driver system, a control system and the optical encoder (Fig. 14).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to incorporate the driving system of Igaki with the optical encoder of Igaki et al. (JP), since one would be motivated to have some form of an automated driving system to rotate the optical scale and operate as a feedback system as shown by Igaki (col. 6, lines 33-53).

Secondly, it would have been obvious, to one having ordinary skill in the art to have the slope angles different or smaller for the first region than those in the second with the suggested systems of Igaki et al. (JP) in view of Igaki, since a mere rearrangement of sizes is generally recognized as being within the level of ordinary skill in the art. As shown by Igaki, the slopes form any angle (col. 4, lines 46-52) meaning as long as it can easily separate the light into two directions. Thus, it would have been within the ability of one having ordinary skill in the art to

choose any angle as long as the light beam incident on the inclined surfaces could be easily separated into different directions to be incident on the different light receiving devices.

9. Regarding claims 16, 17, and 34, Igaki et al. (JP) discloses an optical encoder for detecting an angle, speed, or position of relative rotation or translation comprising (Abstract): a light irradiating system, an optical scale having grating for transmitting or reflecting incident light, light receiving elements disposed in a plurality of different directions (Drawing 14), wherein light travels to the scale slits of a first region to a condensing mirror or optical element to a second region of scale slits (Drawing 14). However, Igaki et al. (JP) does not specifically disclose the second region wherein the V-shape grooves comprises slopes of N types of angles in an number of P/N in one period where P is a pitch of the periodic structure of the scale slits and N a natural number or a driving system comprising: a driver system, a control system, and the optical encoder.

Igaki teaches a driving system comprising: a driver system, a control system and the optical encoder (Fig. 14). Igaki et al. (JP) further discloses a number of 1/2 and 1/4 for a V-groove (Technique, [005]).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to incorporate the driving system of Igaki with the optical encoder of Igaki et al. (JP), since one would be motivated to have some form of an automated driving system to rotate the optical scale and operate as a feedback system as shown by Igaki (col. 6, lines 33-53).

Second, it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the V-shape grooves comprising slopes of N types of angles in an

number of P/N in one period where P is a pitch of the periodic structure of the scale slits and N a natural number with the suggested systems of Igaki et al. (JP) in view of Igaki, since the change in the number of P/N in one period would have involved a mere change in the size of a component. A mere change in size to match the expediency of one's intentions for a particular system is generally recognized as being within the level of ordinary skill in the art.

10. Regarding claims 18-22, 26-29, and 35, Igaki et al. (JP) discloses an optical encoder for detecting an angle, speed, or position of relative rotation or translation comprising (Abstract): a light irradiating system, an optical scale having grating for transmitting or reflecting incident light, light receiving elements disposed in a plurality of different directions (Drawing 14), wherein light travels to the scale slits of a first region to a condensing mirror or optical element to a second region of scale slits (Drawing 14), wavefront division by a difference between reflecting directions (Drawing 13), and reflecting and transmitting portions for the first region having flat portions and V-grooves (Drawing 13). However, Igaki et al. (JP) does not specifically disclose a second region emitting beams in four different directions from different portions or a driving system comprising: a driver system, a control system, and the optical encoder.

Igaki teaches a driving system comprising: a driver system, a control system and the optical encoder (Fig. 14).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to incorporate the driving system of Igaki with the optical encoder of Igaki

et al. (JP), since one would be motivated to have some form of an automated driving system to rotate the optical scale and operate as a feedback system as shown by Igaki (col. 6, lines 33-53).

Secondly, it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a second region emit beams in four different directions with the suggested systems of Igaki et al. (JP) in view of Igaki, which is explained with motivation as follows.

Since the change in planes and rearrangement of V-grooves as explained above would be within the general skill for one having ordinary skill in the art, the change to have four different beams would obviously follow. Lacking any criticality, one may choose to have the second region emitting beams in two, three, four, five, six, or any plurality of directions from different portions, respectively. The number of different beams emitted from a respective position can change as long as the beams emitted from the second region diverge from each position based on the slit pattern of the encoder. Since one can use any slit pattern involving flats and grooves, an infinite number of patterns can emerge from the second region.

11. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Igaki et al. (JP) in view of Igaki as applied to claim 1 above, and in further view of Igaki et al. (US Patent 5,483,059).

12. Regarding claim 2, Igaki et al. (JP) in view of Igaki discloses an optical encoder as recited above. However, Igaki et al. (JP) does not disclose the dividing element forming at least one set of beams having a phase relation of 180°.

Igaki et al. (US) teaches at least one set of beams having a phase relation of 180° (col. 10, lines 9-18).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the phase relation of 180° of Igaki et al. (US) with the suggested systems of Igaki et al. (JP) in view of Igaki, since one would be motivated to have any phase difference to create an analog signal to detect displacement information as shown by Igaki et al. (US) (col. 10, lines 38-39).

13. Regarding claim 3, Igaki et al. (JP) in view of Igaki and Igaki et al. suggests an optical encoder as recited above. Igaki et al. (JP) further discloses repetition two types of different planes (Fig. 4b). However, Igaki et al. (JP) does not specifically disclose the dividing element comprising repetitions of four types of different planes.

Lacking any criticality, it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have repetitions of four types of different planes with the suggested systems of Igaki et al. (JP) in view of Igaki, since the change of in the number of planes for V-grooves would be within the general skill for one having ordinary skill in the art. This is exemplified in the prior art. Igaki teaches zero different planes in one embodiment (col. 2, lines 57-60) to separate light into different directions. Igaki further teaches the capability of having two different planes (col. 4, lines 46-53) to separate light into different directions. Thus, one may choose to have repetitions of zero, two, four, six, eight, ten, or any even number of different planes as long as it caused the light beam incident on the inclined surfaces to easily be separated into different directions to be incident on different light receiving devices.

14. Claims 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Igaki et al. (JP) in view of Igaki as applied to claim 18 above, and in further view of Dil (US Patent 4,746,792).

15. Regarding claims 23 and 24, Igaki et al. (JP) in view of Igaki suggests a system as recited above. However, Igaki et al. (JP) does not disclose the first region of periodic structure for giving reflected light a periodic path difference of a half wavelength in every other width for a cross section with flat portions.

Dil teaches a periodic structure for giving reflected light a periodic path difference of a half wavelength in every other width for a cross section with flat portions (Fig. 4).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the half wavelength difference of Dil with the suggested system of Igaki et al. (JP) in view of Igaki, since one would be motivated to suppress the zero-order diffraction beam as shown by Dil (Abstract).

16. Regarding claim 25, Igaki et al. (JP) in view of Igaki suggests a system as recited above. However, it does not specifically disclose the first region of periodic structure for giving reflected light a periodic path difference of a quarter wavelength in every other depth for a cross section with V-grooves.

Dil teaches a quarter wavelength in every other depth for a cross section with grooves (col. 6, lines 56-60).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the quarter wavelength in every other depth of V-grooves with the suggested system of Igaki et al. (JP) in view of Igaki, which is shown with motivation as follows.

Although Igaki et al. (JP) in view of Igaki does not specifically disclose a first region of V-grooves, it would have been obvious to one having ordinary skill in the art at the time the invention was made, to have the first region of V-grooves with the suggested system of Igaki et al. (JP) in view of Igaki since omission of an element and its function in a combination where the remaining elements perform the same functions as before involves only routine skill in the art. In this situation, omission of the flat portion and its function of reflecting light in a combination where V-grooves perform the same function as before involve only routine skill in the art.

Secondly, although the grooves of Dil are flat grooves, the application of the quarter wavelength depth for every other V-groove in the suggested would be analogous. Figure 4 of Dil shows the depth change for every other flat portion. Figure 34 of the instant application shows the depth change for every other V-groove. Obviously as shown from the pictures, every flat region where the depth is changed corresponds to every V-groove region where the depth is changed. One would be motivated to have the depth change in the V-grooves since it would suppress the zero-order diffraction beam as shown by Dil (Abstract).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Glen Kao whose telephone number is (703) 605-5298. The examiner can normally be reached on M - Th (8 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

gk
October 15, 2001

ROBERT H. KIM
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800